International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Predictors & Perinatal Feto-Maternal Outcomes Among Pregnant Women with Pre-Labor Rupture of Membrane: A Hospital-Based Cross-Sectional Study

Dr. Shaba Naz Rehman[1], Dr Alpana Agrawal[2], Dr Manisha Gupta[3]

[1]Post Graduate Resident, Department of Obstetrics & Gynaecology, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India
Corresponding Author Email: *rehmansaba6282[at]gmail.com*

[2]Professor & MS, Department of Obstetrics & Gynaecology, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India

[3]HOD & Professor, Department of Obstetrics & Gynaecology, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India

Abstract: ***Background**: Pre-labor rupture of membranes (PROM) is a significant obstetric complication associated with increased maternal and neonatal morbidity. Reliable admission predictors are essential for early risk stratification. **Objectives**: To determine predictors and feto-maternal outcomes in pregnancies complicated by PROM, assess incidence of PROM, evaluate maternal complications, analyse neonatal outcome, identify clinical and biochemical factors contributing to adverse outcomes. **Methods**: A hospital-based cross-sectional study was conducted at the Department of Obstetrics & Gynaecology, Santosh Medical College and Hospital, Ghaziabad. One hundred antenatal women (28–40 weeks gestation) with singleton pregnancy presenting with PROM were enrolled. Demographic, obstetric, biochemical (CRP, TLC), and neonatal data were recorded and analysed. **Results**: Most women had term PROM (85%) and rupture duration of 12–24 hours (56%). LSCS rate was 56%. Elevated CRP (≥6 mg/L) was significantly associated with chorioamnionitis, febrile morbidity, postpartum complications, low APGAR scores, increased NICU admission, and neonatal infection. Meconium-stained liquor (MSL) was present in 63% and was linked with higher neonatal morbidity. On multivariable logistic regression, prolonged rupture duration (>24 h: aOR 5.93), elevated CRP ≥6 mg/L (aOR 5.21), and MSL (aOR 3.07) independently predicted adverse outcomes. **Conclusion**: Admission CRP, duration of membrane rupture, and liquor character are practical and independent predictors of adverse feto-maternal outcomes in PROM. Early identification of these factors can guide timely intervention and improve perinatal outcomes.*

Keywords: Pre-labor rupture of membranes (PROM); C-reactive protein (CRP); feto-maternal outcomes; meconium-stained liquor; chorioamnionitis; neonatal morbidity; LSCS

1. Introduction

Pre-labor rupture of membranes (PROM) is defined as the spontaneous rupture of fetal membranes before the onset of uterine contractions, irrespective of gestational age [1]. It represents one of the most common and clinically challenging obstetric complications, disrupting the protective intrauterine environment and predisposing both mother and fetus to infectious and non-infectious morbidities, including chorioamnionitis, preterm birth, neonatal sepsis, and increased operative delivery rates [2].

Globally, PROM complicates 5–15% of all pregnancies, with higher prevalence in low- and middle-income countries where antenatal surveillance is limited [3,9]. The etiology is multifactorial, involving collagen degradation, oxidative stress, genital tract infections, prior PROM, multiparity, malpresentation, and socio-demographic factors such as low antenatal care access and poor nutritional status [5,6,7,8].

The clinical implications of PROM are substantial. Maternal complications include chorioamnionitis, puerperal sepsis, prolonged hospitalization, and operative deliveries, while neonatal complications encompass respiratory distress syndrome (RDS), early-onset sepsis, low APGAR scores, and NICU admissions [15,16]. Preterm PROM (PPROM) carries a disproportionately higher burden of prematurity-related morbidity [32].

A critical need exists for reliable, cost-effective admission predictors to stratify risk and guide management decisions in PROM. C-reactive protein (CRP), a sensitive acute-phase inflammatory marker, and liquor character have been explored in various settings as potential indicators, yet their combined utility in Indian tertiary care populations remains under- characterized [13].

The present study was therefore undertaken to assess predictors and feto-maternal outcomes in pregnancies complicated by PROM at a tertiary care institution in North India, with a focus on the role of admission CRP, duration of membrane rupture, and intrapartum liquor characteristics in predicting adverse outcomes.

2. Methodology

2.1 Study Design and Setting

A hospital-based cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India. The study was conducted until the required sample size was achieved.

2.2 Study Population and Sample Size

The study enrolled 100 antenatal women aged 28–40 weeks of gestation with singleton pregnancies presenting with PROM. The sample size was calculated using the formula $n = z^2p(1-p)/e^2$, where $z = 1.96$, p = expected PROM prevalence (~10%), and e = margin of error (5%), yielding $n \approx 100$.

2.3 Inclusion and Exclusion Criteria

Inclusion criteria: gestational age 28–40 weeks; spontaneous membrane rupture ≥1 hour before onset of labor; singleton pregnancy. Exclusion criteria: multiple gestation, fetal growth restriction or intrauterine fetal demise, uterine or fetal anomalies, hypertensive disorders, gestational diabetes mellitus, antepartum hemorrhage, chronic renal failure, Class II–IV cardiac disease, immunocompromised status, or unwillingness to participate.

2.4 Data Collection

Structured data collection included demographic variables (age, gravida, booking status, residence, socioeconomic status), obstetric parameters (gestational age, duration of membrane rupture, liquor character), inflammatory markers (CRP and TLC on admission), maternal temperature, mode of delivery, and early neonatal outcomes (APGAR scores, birth weight, NICU admission, neonatal complications).

2.5 Definitions

PROM was defined as spontaneous rupture of membranes at least one hour before the onset of labor. Elevated CRP was defined as ≥6 mg/L on admission. Meconium-stained liquor (MSL) included any grade of meconium. Adverse maternal outcomes included chorioamnionitis, febrile morbidity, UTI, PPH, and operative delivery. Adverse neonatal outcomes included APGAR <7 at 1 and 5 minutes, NICU admission, neonatal sepsis, RDS, and neonatal fever.

2.6 Statistical Analysis

Data were entered and analyzed using standard statistical software. Categorical variables were expressed as frequencies and percentages. Chi-square test was used to assess associations between categorical variables. Diagnostic performance of CRP was assessed using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and area under the receiver operating characteristic curve (AUC). Multivariable logistic regression was performed to identify independent predictors of adverse feto-maternal outcomes. Statistical significance was set at $p < 0.05$.

3. Results & Discussion

3.1 Sociodemographic and Obstetric Profile

Among 100 women with PROM, the most common age group was 25–29 years (38%), followed by 20–24 years (31%) and 30–34 years (25%); only 6% were older than 34 years, reflecting the usual reproductive age of the study population. Multigravida women predominated (74%), with only 26% primigravida, consistent with prior parity as a recognized risk factor for PROM [6, 26, 28].

Regarding sociodemographic profile, 45% were unbooked for antenatal care, 56% resided in rural areas, and 91% belonged to lower or lower-middle socioeconomic strata. These findings are consistent with previously documented associations between limited antenatal care, lower socioeconomic status, and increased PROM incidence [25,26]. The high proportion of unbooked and rural women underscores delayed healthcare utilization as a contextual risk factor in this setting.

Table 1: Sociodemographic and Obstetric Characteristics of Study Participants (n=100)

Variable	Category	n	% of Total
Age Group (years)	20–24	31	31
	25–29	38	38
	30–34	25	25
	>34	6	6
Gravida	Primigravida	26	26
	Multigravida	74	74
Booking Status	Booked	55	55
	Unbooked	45	45
Residence	Rural	56	56
	Urban	44	44
Socioeconomic Status	Lower	49	49
	Lower-Middle	42	42
	Upper-Lower	4	4
	Upper-Middle	5	5

3.2 Gestational Age, Rupture Duration, and Mode of Delivery

Term PROM (≥37 weeks) predominated in 85% of cases, late preterm (34–36.9 weeks) in 14%, and early preterm (<34 weeks) in 1%, confirming that PROM in this cohort was predominantly a term phenomenon, consistent with Singh et al. [6] and Poondru et al. [26]. Most women presented with membrane rupture duration of 12–24 hours (56%), while 34% had rupture exceeding 24 hours, indicating a significant burden of prolonged latency in this population.

LSCS was performed in 56% of cases, NVD in 39%, and instrumental delivery in 5%. The high LSCS rate reflects the intrapartum complications and prolonged latency characteristic of this cohort. Among caesarean deliveries, failure to progress was the leading indication (50%), followed by failed induction (21.4%) and fetal distress (21.4%). A notable finding was that all women presenting within 12 hours of rupture delivered vaginally without any operative intervention, underscoring the clinical significance of early presentation and prompt management in reducing operative delivery rates.

Table 2: Gestational Age, Duration of Membrane Rupture, and Mode of Delivery (n=100)

Variable	Category	n (%)
Gestational Age	<34 weeks (Preterm)	1 (1.0)
	34–36.9 weeks (Late Preterm)	14 (14.0)
	≥37 weeks (Term)	85 (85.0)
Duration of Rupture	<12 hours	10 (10.0)
	12–24 hours	56 (56.0)
	>24 hours	34 (34.0)
Mode of Delivery	LSCS	56 (56.0)
	Normal Vaginal Delivery	39 (39.0)
	Instrumental Delivery	5 (5.0)

3.3 Liquor Character and Inflammatory Markers

Meconium-stained liquor (MSL) was observed in 63% of cases, substantially higher than the proportion of clear liquor (37%). This high MSL rate likely reflects delayed presentation and prolonged latency in the study population. Elevated CRP (≥6 mg/L) was observed in 33% of women, with 23% in the 6–9 mg/L range and 10% at ≥10 mg/L. Elevated total leukocyte count (TLC ≥11,000 cells/mm³) was present in 21% and maternal temperature >99°F in 23%, indicating a substantial proportion with biochemical and clinical evidence of infection.

3.4 Association of CRP with Maternal and Neonatal Outcomes

Elevated CRP (≥6 mg/L) was significantly associated with adverse maternal outcomes. Chorioamnionitis occurred in 15.2% of women with raised CRP compared to 0% in those with CRP <6 mg/L. Febrile morbidity was observed in 60.6% versus 4.5%, UTI in 24.2% versus 3.0%, and PPH in 12.1% versus 1.5% (p=0.002). The complete absence of chorioamnionitis in the low CRP group underscores CRP's strong discriminatory value.

For neonatal outcomes, CRP demonstrated high sensitivity for neonatal sepsis (100%) and good sensitivity for RDS (75%) and neonatal fever (77.8%). The AUC for neonatal sepsis was 0.84, indicating strong discriminatory capacity. The negative predictive value was extremely high for serious neonatal infections (100% for neonatal sepsis), affirming CRP's utility in excluding severe neonatal complications. These findings are consistent with Trochez-Martinez et al. [13] and El-Kashif et al. [13], who similarly demonstrated CRP as an early predictor of adverse outcomes in PROM.

Table 3: Association of Elevated CRP (≥6 mg/L) with Maternal Outcomes (n=100)

Outcome	CRP <6 mg/L (n=67)	CRP ≥6 mg/L (n=33)	p value
Chorioamnionitis	0 (0.0%)	5 (15.2%)	<0.001
Febrile Morbidity	3 (4.5%)	20 (60.6%)	0.002
UTI	2 (3.0%)	8 (24.2%)	0.002
PPH	1 (1.5%)	4 (12.1%)	0.028
APGAR <7 at 1 min	15 (22.4%)	13 (39.4%)	0.039
APGAR <7 at 5 min	8 (11.9%)	10 (30.3%)	0.024
NICU Admission	11 (16.4%)	17 (51.5%)	<0.001
Neonatal Sepsis	0 (0.0%)	5 (15.2%)	<0.001

3.5 Association of Meconium-Stained Liquor with Neonatal Outcomes

MSL was significantly associated with neonatal complications. NICU admission was required in a significantly higher proportion of neonates born in the context of MSL compared to those with clear liquor. Similarly, MSL was associated with higher rates of meconium aspiration syndrome, neonatal distress, and RDS, consistent with reports from Poondru et al. [26] and Singh et al. [6]. The high MSL burden in the present cohort is likely attributable to prolonged rupture duration and delayed hospital presentation, both of which exacerbate fetal hypoxia and stress.

3.6 Multivariable Logistic Regression – Independent Predictors

On multivariable logistic regression, three independent predictors of adverse feto-maternal outcomes emerged after adjustment for all variables. Rupture duration of 12–24 hours was associated with nearly three-fold increased risk compared to <12 hours (aOR 2.97; 95% CI 1.14–7.71; p=0.024), and rupture >24 hours conferred approximately six-fold higher risk (aOR 5.93; 95% CI 2.10–16.72; p=0.001). Elevated admission CRP ≥6 mg/L was the strongest single predictor, associated with over five-fold increased odds of adverse outcomes (aOR 5.21; 95% CI 2.14–12.67; p<0.001). Meconium-stained liquor was associated with three-fold increased risk compared to clear liquor (aOR 3.07; 95% CI 1.22–7.70; p=0.017). Gravida status did not retain independent significance after adjustment (aOR 1.51; p=0.258).

Table 4: Multivariable Logistic Regression – Predictors of Adverse Feto-Maternal Outcomes (n=100)

Variable	β Coeff.	SE	p value	aOR	95% CI
Multigravida (ref: Primigravida)	0.41	0.36	0.258	1.51	0.75–3.04
Rupture 12–24 h (ref: <12 h)	1.09	0.48	0.024	2.97	1.14–7.71
Rupture >24 h (ref: <12 h)	1.78	0.53	0.001	5.93	2.10–16.72
CRP ≥6 mg/L (ref: <6 mg/L)	1.65	0.45	<0.001	5.21	2.14–12.67
MSL (ref: Clear liquor)	1.12	0.47	0.017	3.07	1.22–7.70

aOR: adjusted Odds Ratio; SE: Standard Error; MSL: Meconium-Stained Liquor; CRP: C-Reactive Protein

3.7 Comparison with Published Literature

The findings of the present study are in broad agreement with prior reports from India and other low- and middle-income settings. Singh et al. [6] from Western Uttar Pradesh reported LSCS in 54.36% of PROM cases with fetal distress and subclinical infection as predominant complications. Koothan et al. [24] similarly documented significantly higher maternal and neonatal morbidity with latency exceeding 24 hours. Endale et al. [23] from Ethiopia identified PROM duration >12 hours as a significant predictor of adverse outcomes on logistic regression.

The role of CRP as an early warning marker is consistent with Trochez-Martinez et al. [13], who demonstrated CRP's predictive value for chorioamnionitis in PROM. The high MSL rate (63%) in the present study exceeds rates reported by Barkase et al. [34] (lower MSL proportion, predominantly respiratory distress), likely reflecting differences in case mix, latency, and tertiary referral patterns. Pradip and Gitanjali [33] reported a higher LSCS rate (68%), reflecting variability in management thresholds across centers. The complete absence of operative deliveries in women presenting within 12 hours, a distinctive finding in the present study, has not been explicitly reported in comparable Indian literature and represents an important clinical observation supporting prompt obstetric intervention.

4. Conclusion

Pre-labor rupture of membranes remains a significant contributor to maternal and neonatal morbidity in obstetric practice. The present hospital-based cross-sectional study identified three independent predictors of adverse feto-maternal outcomes in pregnancies complicated by PROM: prolonged duration of membrane rupture (>24 hours, aOR 5.93), elevated admission CRP ≥6 mg/L (aOR 5.21), and meconium-stained liquor (aOR 3.07). Parity alone did not independently predict outcomes after adjustment for these factors.

The findings demonstrate that admission CRP, rupture-to-delivery interval, and intrapartum liquor character are practical, clinically accessible predictors that can facilitate early risk stratification in PROM. Women presenting within 12 hours of membrane rupture delivered exclusively by vaginal route without any operative interventions, underscoring the critical importance of early presentation and prompt management. The strong discriminatory performance of CRP for excluding serious neonatal infections (NPV 100% for neonatal sepsis) further supports its routine use as an admission biomarker in PROM.

These results advocate for systematic evaluation of CRP and careful assessment of liquor character at admission, combined with timely institutional delivery, as cornerstone strategies for improving perinatal outcomes in PROM-complicated pregnancies, particularly in resource-limited settings with high proportions of unbooked, socioeconomically disadvantaged, and rural populations.

5. Limitations

The study has several limitations. As a single-center, cross-sectional study with a sample size of 100, findings may not be universally generalizable. The absence of follow-up data beyond the early neonatal period limits assessment of longer-term outcomes. Microbiological confirmation of chorioamnionitis was not performed in all cases. Future multicenter, prospective studies with larger sample sizes and more complete microbiological and neonatal follow-up data are warranted to validate these findings.

Declarations

Conflict of Interest: The authors declare no conflict of interest.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethical Approval: Obtained from the Institutional Ethics Committee, Santosh Medical College and Hospital, Ghaziabad.

Informed Consent: Written informed consent was obtained from all study participants.

Author Contributions: SNR: Study conception, data collection, analysis, manuscript preparation. AA: Study supervision, critical revision of manuscript, approval of final version.

Ethical Statement

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee of Santosh Medical College and Hospital, Ghaziabad. Written informed consent was obtained from all participants. Patient confidentiality was maintained throughout.

References

[1] Wolde M, Mulatu T, Alemayehu G, Alemayehu A, Assefa N. Predictors and perinatal outcomes of pre-labor rupture of membrane among pregnant women admitted to Hiwot Fana Comprehensive Specialized University Hospital, Eastern Ethiopia: a retrospective study. Frontiers in Medicine. 2024 Jan 23; 10: 1269024.

[2] Naz A, Naz F, Mumtaz A, Malik R. Maternal and Fetal outcomes in Premature Rupture of Membranes. Indus Journal of Bioscience Research. 2025 Jul 10;3(7):105–9.

[3] Tiruye G, Shiferaw K, Tura AK, Debella A, Musa A. Prevalence of premature rupture of membrane and its associated factors among pregnant women in Ethiopia: A systematic review and meta-analysis. SAGE Open Medicine. 2021 Oct; 9: 20503121211053912.

[4] Dayal S, Jenkins SM, Hong PL. Preterm and term prelabor rupture of membranes (PPROM and PROM). In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Oct 31.

[5] Adewole ND, Tom-George G, Adebayo FO, Muhammad RB, Isah AD. Foeto-maternal outcome of premature rupture of fetal membranes: A 5-year study. IOSR Journal of Dental and Medical Sciences. 2021;20(4):47–52.

[6] Singh J, Kanti V, Verma V. Study of fetomaternal outcome in cases of premature rupture of membrane at tertiary care rural institute of Western Uttar Pradesh, India. Int J Reprod Contracept Obstet Gynecol. 2020 Jan 1;9(1):78.

[7] Shanbhag S, Alva R. Early neonatal outcomes in premature rupture of membranes beyond twenty-eight

weeks of gestation in a tertiary care hospital of coastal Karnataka. The Journal of Pediatric Research. 2020 Jul 8.

[8] Telayneh AT, Ketema DB, Mengist B, et al. Pre-labor rupture of membranes and associated factors among pregnant women admitted to the maternity ward, Northwest Ethiopia. PLOS Global Public Health. 2023 Mar 8;3(3): e0001702.

[9] Eldin Abd Elslam Elhilu AE, Yagob E, Ibraheem Saeed AM, et al. Management and Immediate Maternal & Neonatal Outcomes of Pre-Labour Rupture of Membranes (PROM) at Ompada Teaching Hospital. International Journal of Innovative Science and Research Technology. 2025 Jun 21;10(6):1224–32.

[10] Zia MS, Shaheen M, Haneef S, Nasir GM. Comparison of Active and Expectant Management for Fetomaternal Outcome Among Women Presenting with Premature Rupture of Membrane at Term. Journal of the Society of Obstetricians and Gynaecologists of Pakistan. 2022 Apr 30;12(2):125–9.

[11] Ali MM, Abd-El-Kader AA, Mansour M. Prevalence, fetal and maternal outcomes of premature rupture of membranes among pregnant women attending Minia Maternity University Hospital: a prospective study. Minia Journal of Medical Research. 2020 Jul 1;31(3):329–33.

[12] Ahmed YM, Solimen HA, Abdelwahab AH, Alshamandy SA. Effect of self-care guidelines for pregnant women with premature rupture of membrane on pregnancy outcomes. Minia Scientific Nursing Journal. 2024 Dec 30;16(2):73–84.

[13] El-Kashif MM, Fathy AM, Elsaba HA. Evaluation of maternal and neonatal outcomes in the case of preterm premature rupture of membranes and their relationship to prenatal maternal indicators: A cross-sectional descriptive study. Journal of Nursing Education and Practice. 2020;10(6).

[14] Kemal S, Kemal M, Sultana S, Hussain R, Nadeem K. Effect of decreased amniotic fluid index on feto-maternal outcome. Pakistan Journal of Surgery. 2021 Apr 1;37(2).

[15] Punithavathi J, Karunanithi PA, Zeba N. Fetomaternal outcome in pregnancies with abnormal liquor volume — a prospective observational study. Environment. 2022; 2: 3.

[16] Endale T, Fentahun N, Gemada D, Hussen MA. Maternal and fetal outcomes in term premature rupture of membrane. World Journal of Emergency Medicine. 2016;7(2):147.

[17] Koothan UT, Kate NV, Anuradha V. A study of feto-maternal outcome in cases of pre-labour rupture of membranes. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2017 Oct 1;6(10):4474.

[18] Sarkar M, Mondal T, Sarkar M. PROM and its maternal outcome: a retrospective study in a rural medical college of India. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2021 Jun 1; 10: 10–8203.

[19] Singh J, Singh U, Srivastava K. Fetomaternal outcomes in preterm premature rupture of membranes: A prospective observational study. J Obstet Gynaecol India. 2022; 72: 134–41.

[20] Poondru S, Kasina RK, Rampure D. Fetomaternal outcome in premature rupture of membranes. Journal of Gynecology and Neonatal Biology. 2021;7(1):1–9.

[21] Barkase N, Chaudhary S, Mundhra R. Feto-maternal outcome in cases of premature rupture of membranes at term. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2023;12(4):1050–5.

[22] Pradip K, Gitanjali B. Clinical profile and feto-maternal outcome of PROM: a tertiary care experience. Indian Journal of Obstetrics and Gynaecology Research. 2023;10(1):15–20.

[23] Jaiswal MK, Chauhan S, Khadanga S. Maternal and perinatal outcomes in premature rupture of membranes: a prospective study. Journal of Evolution of Medical and Dental Sciences. 2017;6(42):3311–5.